【 ORIGINAL ARTICLE 】

Validity of the Pre-endoscopic Scoring Systems for the Prediction of the Failure of Endoscopic Hemostasis in Bleeding Gastroduodenal Peptic Ulcers

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Abstract:
Objective Although several pre-endoscopic scoring systems have been used to predict the mortality or the need for intervention for upper gastrointestinal bleeding, their usefulness to predict the failure of endoscopic hemostasis in bleeding gastroduodenal peptic ulcers has not yet been fully investigated. In this study, we evaluated the usefulness of the Glasgow-Blatchford score (GBS), the clinical Rockall score (CRS), and the AIMS65 score in predicting the failure of endoscopic hemostasis in patients with bleeding gastroduodenal peptic ulcers.
Methods We retrospectively evaluated 226 consecutive emergency endoscopic cases with bleeding gastroduodenal peptic ulcers between April 2010 and September 2016. The study outcome was the failure of first endoscopic hemostasis. The GBS, CRS, and AIMS65 scores were assessed for their ability to predict the failure of endoscopic hemostasis using a receiver-operating characteristic curve.
Results Eight cases (3.5%) failed to achieve first endoscopic hemostasis. Surgery was required in six cases, and interventional radiology was required in two cases. The GBS was superior to both the CRS and the AIMS65 score in predicting the failure of endoscopic hemostasis [area under the curve, 0.77 (95% confidence interval, 0.64-0.90), 0.65 (0.56-0.74) and 0.75 (0.56-0.95), respectively]. No failure of endoscopic hemostasis was noted in cases in which the patient scored less than GBS 10 and CRS 2.
Conclusion The GBS was the most useful scoring system for the prediction of failure of endoscopic hemostasis in patients with bleeding gastroduodenal peptic ulcers. The GBS was also useful in identifying the patients who did not require surgery or interventional radiology.

Key words: failure of endoscopic hemostasis, gastroduodenal peptic ulcers, Glasgow-Blatchford score, Rockall score, AIMS65

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Introduction

Upper gastrointestinal bleeding is one of the most common emergencies and potentially life-threatening conditions in gastroenterology. Endoscopic therapy has widely been accepted as an initial treatment for controlling the bleeding because it provides a clinically important reduction in morbidity and mortality in patients with bleeding gastroduodenal peptic ulcers (1-3). However, there are still instances of bleeding that cannot be controlled through endoscopy.

Several prognostic scoring systems, such as the Glasgow-Blatchford score (GBS), clinical Rockall score (CRS), and AIMS65 score, have been used to predict mortality or the need for intervention before endoscopy for patients suffering from upper gastrointestinal bleeding (4-6). Several reports have shown the usefulness of these scores in the prediction of mortality, as well as in the determination of the need for

intervention and/or transfusion (7-10). However, these scoring systems have not been used to predict the failure of endoscopic hemostasis in bleeding gastroduodenal peptic ulcers. The risk for failure of endoscopic hemostasis in patients with bleeding gastroduodenal peptic ulcers is one of the most important pieces of clinical information for endoscopists.

We therefore investigated the characteristics of cases with failed endoscopic hemostasis and evaluated the usefulness of the GBS, CRS, and AIMS65 scores for the prediction of the failure of endoscopic hemostasis in bleeding gastroduodenal peptic ulcers.

Materials and Methods

We retrospectively reviewed the medical records of all patients who underwent emergency upper gastrointestinal endoscopy at Hirosaki Municipal Hospital in Aomori, Japan between April 2010 and September 2016. During that time period, a total of 18,204 esophagogastroduodenoscopies were performed, with 398 of them involving an emergency upper gastrointestinal endoscopy. Among these cases, we studied the 266 consecutive cases with bleeding gastroduodenal peptic ulcers in 257 patients. Nine patients with 2 instances of bleeding had their second episode of bleeding ≥ 10 months after their first hospital discharge and thus were defined as new cases. For the purpose of this study, emergency endoscopy was defined as an endoscopic examination performed within 12 hours of arrival at the hospital. All cases received intravenous proton pump inhibitors (PPIs) prior to emergency endoscopy. In the cases in which endoscopic therapy failed, surgical procedures or interventional radiology (IVR) was performed. Endoscopic treatment was performed by 5 endoscopists who had over 10 years of experience each. The study outcome was the failure to control bleeding using the first round of endoscopic therapy. Therefore, we did not include rebleeding cases in the failure of endoscopic hemostasis. Endoscopic therapy was performed with ethanol injection, endoscopic clipping, hemostatic forceps coagulation, and hypertonic saline-epinephrine injections. The patients were treated with monotherapy or a combination of therapies as necessary. Hypertonic saline-epinephrine injections were used in combination with other methods because they reduce the risk of rebleeding (11).

The performance of the GBS, CRS, and AIMS65 scores in predicting the failure of endoscopic therapy was assessed using a receiver-operating characteristic (ROC) curve. Other statistical differences were evaluated using either Fisher's exact probability test, chi-squared test, or Mann-Whitney U test. $p < 0.05$ was regarded as statistically significant. The Statistical Package for the Social Science (SPSS) software program, version 20.0 (SPSS, Chicago, USA), was used for the data analyses.

The study protocol was approved by the ethics committee at Hirosaki Municipal Hospital, and the study was conducted in accordance with the Declaration of Helsinki.

Results

Of the 226 enrolled cases, 145 (64.2%) were men, with a mean age of 66.7±13.8 years, and 131 cases (58.0%) needed intervention therapy. Eight cases (3.5%) failed to achieve endoscopic hemostasis (Table 1). Systolic blood pressure, diastolic blood pressure, serum level of albumin, the rates of syncope and ulcer size ≥20 mm, and the GBS and AIMS65 scores were higher in the 8 patients with failure of endoscopic hemostasis than in those with non-intervention or success of endoscopic hemostasis. Seven cases had gastric ulcer, and one case had duodenal ulcer. Surgery was required in six cases, and IVR was required in two cases (Table 2). According to the Forrest classification, 6 cases were Ia, and 2 cases were Ib. Four of the surgery cases experienced penetration. There was one instance of mortality in the subset of patients with a failure of endoscopic hemostasis, while six instances of mortality were observed in the subsets of patients with non-intervention or success of endoscopic hemostasis (Table 3). No significant differences were noted in the mortality rate between the two groups. However, the rate of blood transfusion was higher and the length of hospitalization longer in the group that failed endoscopic hemostasis than in those with non-intervention or successful endoscopic hemostasis. In addition, there was no cases of failure of endoscopic hemostasis in any patients who scored less than GBS 10 (Fig. 1A) or CRS 2 (Fig. 1B). Failure of endoscopic hemostasis occurred in one patient who scored AIMS65 score 0 (Fig. 1C).

The ROC curves of the GBS, CRS, and AIMS65 scores for the prediction of failure of endoscopic hemostasis in non-variceal upper gastrointestinal bleeding are shown in Fig. 2. The GBS was superior to both the CRS and AIMS65 scores for the prediction of failure of endoscopic hemostasis [areas under the curve of 0.77 (95% confidence interval, 0.64-0.90), p=0.010; 0.65 (0.56-0.74), p=0.152; and 0.75 (0.56-0.95), p=0.015, respectively].

Discussion

The present study found that the GBS scoring system was the most useful for the prediction of failure of endoscopic hemostasis in patients with bleeding gastroduodenal peptic ulcers. Systolic blood pressure, diastolic blood pressure, albumin levels, and syncope were all associated with the failure of endoscopic hemostasis in the present study. Although patient levels of hemoglobin were not significantly different among the subgroups evaluated, the patients who experienced failure of endoscopy hemostasis tended to have lower levels of hemoglobin. As a means to identify the factors inducing the failure of endoscopic hemostasis in the bleeding gastric ulcer, hypovolemic shock, hypoalbuminemia, and low levels of hemoglobin were used as predictive factors for the failure of endoscopic hemostasis, even though their outcomes included rebleeding cases (12-14). Among these fac-

Table 1.   The Characteristics at Admission.

Variables	Failure of endoscopic hemostasis	Non-intervention or success of endoscopic hemostasis	p value
	(n=8)	(n=218)	
Male, n (%)	4 (50)	141 (65)	0.46
Age (years), mean±SD	61.5±6.4	66.9±13.9	0.16
Systolic blood pressure (mmHg), mean±SD	87±23	118±27	<0.001
Diastolic blood pressure (mmHg), mean±SD	55±19	71±17	0.005
Pulse rate (beats per minute), mean±SD	99±15	92±20	0.28
Hemoglobin (g/dL), mean±SD	7.3±2.2	9.3±3.2	0.10
Albumin (mg/dL), mean±SD	2.7±0.3	3.2±0.6	0.004
Blood urea nitrogen (mg/dL), mean±SD	31±11	37±21	0.42
PT-INR, mean±SD	1.4±0.5	1.1±0.5	0.14
Syncope, n (%)	3 (38)	14 (6)	0.016
Hepatic disease, n (%)	0	9 (4)	1
Cardiac failure, n (%)	0	6 (3)	1
Renal failure, n (%)	0	11 (5)	1
Malignant metastasis, n (%)	0	6 (3)	1
Medication			
Antiplatelet agents, n (%)	0	20 (9)	1
Anticoagulant drug, n (%)	1 (13)	26 (12)	1
NSAIDs medication, n (%)	0	50 (23)	0.20
PPI medication, n (%)	1 (13)	27 (12)	1
H2blocker medication, n (%)	0	16 (7)	1
Glasgow-Blachford score, median (IQR)	13.5 (11.75-14.25)	11 (7-13)	0.010
Clinical Rockall score, median (IQR)	2.5 (2-3)	2 (1-3)	0.15
AIMS65 score, median (IQR)	2 (1.75-3)	1 (0-2)	0.015

PT-INR: prothrombin time-international normalized ratio, NSAIDs: non-steroidal anti-inflammatory drugs, PPI: proton pump inhibitor, IQR: interquartile range

Table 2.   The Characteristics of the Patients with Failure of Endoscopic Hemostasis.

Age	Sex	Ulcer location	Forrest classification	Ulcer size	Intervention	Penetration	Systolic blood pressure <85 mmHg	Diastolic blood pressure <60 mmHg	Syncope	GBS	CRS	AIMS 65
65	F	Posterior wall of the body	Ia	54×40 mm	Surgery	yes	yes	yes	no	10	3	2
61	F	Posterior wall of the angulus	Ia	50×25 mm	Surgery	yes	no	no	no	11	2	0
52	M	Lesser curvature of the body	Ia	47×20 mm	Surgery	no	yes	yes	yes	12	2	1
60	M	Lesser curvature of angulus	Ib	31×18 mm	Surgery	no	yes	yes	no	14	3	3
55	F	Posterior wall of the angulus	Ia	40×15 mm	Surgery	yes	yes	yes	no	14	2	2
59	M	Posterior wall of the body	Ia	98×46 mm	Surgery	yes	yes	yes	yes	15	2	4
66	M	Lesser curvature of angulus	Ib	≥30 mm	IVR	no	yes	yes	yes	16	3	3
74	F	Posterior wall of duodenal bulb	Ia	≥30 mm	IVR	no	no	yes	no	13	3	2

GBS: Glasgow-Blachford score, CRS: Clinical Rockall score, IVR: Interventional radiology

Table 3.   Outcomes and Endoscopic Findings after Endoscopy.

	Failure of endoscopic hemostasis	GBS	CRS	AIMS65	Non-intervention or success of endoscopic hemostasis	GBS	CRS	AIMS65	p value
	(n=8)		mean		(n=218)		mean		
Surgery, n (%)	6 (75)				0				<0.001
Interventional radiology, n (%)	2 (25)				0				0.001
Endoscopic intervention, n (%)	8 (100)				123 (56)				0.022
Mortality, n (%)	1 (13)				2 (1)				0.10
Rebleeding	0 (0)				7 (3)				1.000
Blood transfusion, n (%)	8 (100)				119 (55)				0.010
Length of hospitalization, mean±SD	27±12				14±10				0.005
Ulcer location									
Upper parts of the stomach, n (%)	0 (0)				19 (9)	10.0	2.5	1.3	1.000
Middle parts of the stomach, n (%)	6 (75)	13.1*	2.5	2.1**	140 (64)	10.2	2.2	1.2	0.715
Lower parts of the stomach, n (%)	1 (13)	11.0	2.0	1.0	18 (8)	9.8	2.1	0.8	0.510
Duodenal bulb, n (%)	0 (0)				32 (15)	7.4	1.2	0.6	0.605
Second portion of duodenum, n (%)	1 (13)	13.0	3.0	2.0	9 (4)	11.6	3.2	1.4	0.406
Forrest classification									
Ia, n (%)	6 (75)	13.2	2.3	2.0	9 (4)	10.6	1.8	1.1	<0.001
Ib, n (%)	2 (25)	13.0	3.0	2.5	30 (14)	11.5	2.7	1.4	0.316
IIa, n (%)	0 (0)				84 (39)	11.2	2.2	1.1	0.027
IIb, n (%)	0 (0)				30 (14)	6.2	1.3	0.7	0.601
IIc, n (%)	0 (0)				61 (28)	9.2	2.2	1.1	0.112
III, n (%)	0 (0)				4 (2)	1.0	0.5	0.5	1.000
Size of ulcer									
≥20 mm, n (%)	8 (100)	13.1	2.5	2.1	64 (29)	10.8	2.4	1.3	<0.001
<20 mm, n (%)	0 (0)				154 (71)	9.4	1.9	0.9	<0.001

* p<0.05 (Failure of endoscopic hemostasis vs. non-intervention or success of endoscopic hemostasis)

** p<0.01 (Failure of endoscopic hemostasis vs. non-intervention or success of endoscopic hemostasis)

tors, the GBS score included systolic blood pressure, syncope, and hemoglobin, the AIMS65 included systolic blood pressure and albumin, and the CRS score included only systolic blood pressure. This may explain why the area under the curve (AUC) for the GBS score was superior to that of the other two scoring systems.

Although several studies have reported the usefulness of the GBS scoring system for evaluating outcomes included in the mortality and the need for intervention, they did not investigate the use of the GBS score for the prediction of the failure of endoscopic hemostasis in bleeding gastroduodenal peptic ulcers (7, 9, 10). Only one previous study investigated the need for surgery using data from the GBS and CRS systems in the evaluation in patients with all manner of upper gastrointestinal bleeding (8), and it showed the GBS score to be superior to the CRS score as well as the mortality, thus indicating the need for intervention. However, the AUC for the GBS score in that study was lower than that in our results; furthermore, only 13% of the cases lacked any findings regarding the bleeding source. Moreover, our study included only bleeding gastroduodenal peptic ulcers. Therefore, the AUC for the GBS score in our study was superior.

The GBS score was also found to be useful for identify-ing patients who do not require surgery or IVR. In the present study, patients who had a GBS score <10 did not require surgery or IVR. However, one of the patients who had an AIMS65 score of 0 needed surgery. Although the AUC for the AIMS65 score was higher than 0.7, the AIMS65 was not available for use in the prediction of patients who might require surgery or IVR. In the previous study investigating the need for surgery, patients who had a GBS score <8 did not need surgery (8). In contrast, many patients who had a GBS score ≥10 successfully achieved endoscopic hemostasis. As such, the GBS score may also be useful, especially for identifying patients who do not require surgery or IVR following treatment for bleeding gastroduodenal peptic ulcers.

In the cases with surgery or IVR, the ulcer size was more than 30 mm. All lesions that failed endoscopic hemostasis were large and deep ulcers. Among the six surgery cases, four had large ulcers with penetration. All lesions with penetration existed in the posterior wall of the stomach. Had these lesions existed in the anterior wall of the stomach, peritonitis caused by perforation might have happened before the symptoms of bleeding became apparent. The bleeding ulcers in the posterior wall of the stomach included
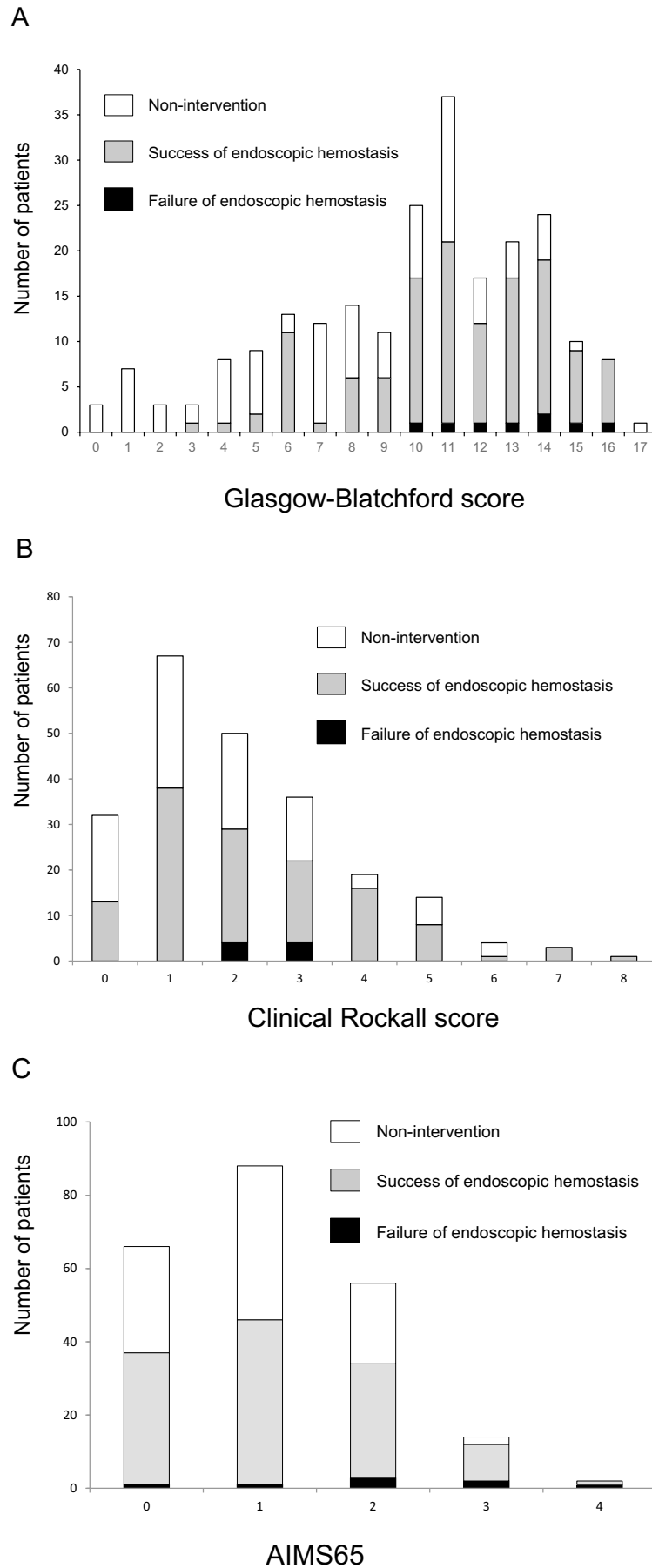
Figure 1.   Distribution of patients with non-intervention or successful endoscopic hemostasis and failed endoscopic hemostasis, according to the (a) Glasgow-Blatchford score, (b) the clinical Rockall score, and (c) the AIMS65 score.
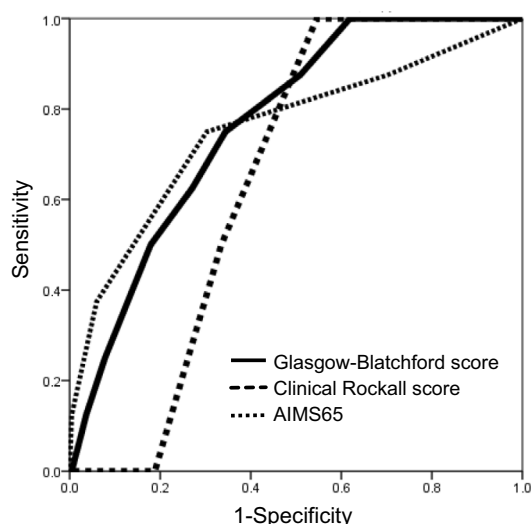
Figure 2.   **Comparison of the Glasgow-Blatchford score, the Clinical Rockall score, and the AIMS65 with AUC figures for the prediction of the failure of endoscopic hemostasis. The AUC for the Glasgow-Blatchford score was 0.77 (95% confidence interval, 0.64-0.90), that for the clinical Rockall score was 0.65 (0.56-0.74), and that for the AIMS65 was 0.75 (0.56-0.95).**

large ulcers with penetration. Large and deep ulcers with penetration were factors influencing the failure of endoscopic hemostasis with bleeding gastric ulcers.

Several limitations associated with the present study warrant mention. First, this is a retrospective analysis of a small number of patients in a single institution. Second, we were unable to perform a multiple regression analysis in this study because of the small number of patients who failed endoscopic hemostasis. Therefore, we surveyed our population using ROC curves. Failure of endoscopic hemostasis was very rare, so further multicenter studies are required. Third, this study did not investigate cases of rebleeding. However, seven rebleeding cases were controlled using endoscopic therapy.

In conclusion, the GBS score was found to be superior to the CRS and AIMS65 scoring systems in the prediction of the failure of endoscopic hemostasis. Our results also suggest that the GBS score may be useful for identifying low-risk patients who do not need surgery or IVR.

The authors state that they have no Conflict of Interest (COI).

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